# Name: Date: Period:

# Paper Versus E-Paper

# Paper

Paper was invented in China about 2,000 years ago. Since that time, paper has become a vital part of our society. Today we can make things out of paper, such as cups, plates, and cardboard. Our economy is based on money that is printed on paper. But, probably the most important use of paper is for written communication. You probably read something out of your textbook today, and used paper to take notes or do your homework. Virtually every aspect of today's society relies on paper.

One of the reasons paper is such a useful item is because it is relatively inexpensive to produce. Paper mills produce huge quantities of paper each day to keep up with demand. Because of this, there is a lot of paper to go around, and it is inexpensive.

Paper may be inexpensive and readily available, but it also has its drawbacks. The production and use of paper can be harmful to the environment. As your textbook shows, making paper is a multi-step process. Each one of those steps requires energy. The process also produces wastes. The forest products industry (which includes paper production) generates over two billion tons of waste each year in the United States. Individuals also use and dispose of an incredible amount of paper everyday. The average American uses about 700 pounds of paper products every year! Fortunately more and more people are recycling paper, but most of this paper ends up in landfills.

## E-Paper

As an individual consumer, you can reduce paper waste by reusing and recycling whenever possible. Also, engineers and scientists are looking for ways to reduce the overall amount of paper that is used. One idea that they are working on is known as electronic paper and electronic ink, or "e-paper" and "e-ink".

There are currently two companies developing e-ink. While the two companies are using slightly different techniques, the basic ideas are the same. E-ink is actually millions of tiny hollow spheres, called microcapsules, suspended in a liquid. The microcapsules are so small that roughly 100,000 of them fit onto a single square inch of paper. Inside each microcapsule are hundreds of colored particles. The colored particles are negatively charged. To work, the e-ink is painted onto a piece of e-paper. E-paper is a thin piece of material that contains millions of tiny electric transistors. Each transistor can produce a negative or positive charge. When a transistor produces a negative charge, the colored particles rise to the top of the microcapsule. When a transistor produces a positive charge, the colored particles sink to the bottom of the microcapsule. By changing the charge for each electronic transistor, a pattern of white and black dots appear, forming letters, words, and pictures.

E-paper and e-ink have some advantages over traditional paper and ink. One of the most important advantages is that e-ink and e-paper can be reused over and over again. For example, instead of buying a newspaper everyday and then throwing it out when you have read it, someday you could have a device that could download the morning paper onto the same piece of e-paper that you used to read yesterday's newspaper. This would significantly reduce the amount of waste generated, and may reduce the cost of producing the newspaper. Also, e-ink and e-paper use a significantly less amount of energy than current electronic display systems. Devices such as TV's, computer screens, and electronic billboards all use electricity constantly, even if the message or picture is not changing. E-ink and e-paper only use electricity to create new images when you are ready for the new image. For example, if you are reading a book and it takes you 5 minutes to read a page, the e-paper only uses electricity to change the image once every five minutes. However, if you read the same page on computer screen, the computer screen updates the image 60 times each second, even if the image is not changing.

A form of e-paper is also being developed that would allow a user to write on it like traditional paper, as opposed to only downloading material. This e-paper would come with a device called a "wand". The wand would act like the electrical transistors, in that it would apply a charge to the e-paper to make a dot of color. The idea is similar to that of using a stylus to write on a hand-held electronic device, like a Personal Digital Assistant (PDA). This "wand" can also be used like an eraser. This means that unlike traditional paper, e-paper can be reused countless times.

E-ink and e-paper also have some disadvantages over traditional paper and ink. The current technology has not yet produced the paper-thin sheets that the makers of e-paper have envisioned. Currently, e-paper devices look and feel more like small laptop computers than pieces of paper. Another drawback is download time. Currently the amount of time to download material to be printed onto an e-paper device is relatively slow. Over time, improvements in technology should solve these problems. However, even when that time comes, there may be many people that would prefer to sit down and read a traditional paper and ink book than to read a book on e-paper.